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COMPUTER ABSTRACTS

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GENERAL

205 **Bittebittehaha.** W. Phillips, *Computer Bull.*, **4,** Dec. 1960, 84-85. Article criticising a proposal appearing in the American periodical *Science* that binary numbers should be said by using either "bim" for 1 and "bam" for 0 or "bit" for 1 and "te" for 0, and advocating the adoption of a proposal, made in 1936, relying on the ready conversion between binary and octonary scales. Thus, if the binary equivalent of decimal 1,967 is marked off in threes—11, 110, 101, 111, it can be read as "three six five seven" instead of "bitbitbitbittebittebitbitbitbit" as required by the American proposal.

206 **Characteristics of computers of the second decade.** D. Hooper, *Computer Bull.*, **4,** Dec. 1960, 87. Brief report of a discussion meeting of the British Computer Society on 22 September 1960, at which the paper abstracted in Ref. 360 was given.

207 **Computer courses for colleges.** M. M. Barritt, *Computer Bull.*, **4,** Dec. 1960, 82-83. Discussion of some problems which are peculiar to the use of a digital computer in a technical college (as opposed to a university) and indication of the kinds of courses which may be provided.

208 **Computing services survey.** N. Macdonald, *Computers & Automn.*, **9,** Dec. 1960, 7-11. A survey of 61 U.S., 1 Canadian and 3 British computing services listing equipment, problems specialised in and other details.

209 **COPE (Console Operator Proficiency Examination).** D. Farbman and R. Ketover, *Commun. ACM*, **3,** Dec. 1960, 661-662. This paper outlines COPE (Console Operator Proficiency Examination), a program for testing the capabilities and aiding the training of computer console operators. The program was developed specifically for the IBM 705 Model II with two Tape Record Coordinators.

210 **Reflections on the IDP mission to U.S.A.** J. G. Grover, *Computer Bull.*, **4,** Dec. 1960, 77-81. Random recollections of a member of the European Productivity Agency's mission to study integrated data processing in the U.S.A. during April-June 1960. The general conclusion is that "electronic data processing is here to stay. Not because it is too difficult to go back, but because it will pay its way". Topics dealt with include rapid advances in miniaturisation; greater speed; character recognition; data transmission; movement of data within the organisation; real time applications; time sharing; operational research influences; business users; approach to integration; program maintenance; automatic programming; stimulus of government interest; and training facilities.

211 **The Sumador Chino.** J. L. Rogers, *Commun. ACM*, **3,** Nov. 1960, 621-622. Description of an adding device, called the *sumador chino* (Chinese adder), which the author discovered in Mexico. Similar in principle to the abacus, it is somewhat simpler to operate. Information is requested concerning the evolution and present status of the *sumador chino*.

212 **What can we learn from the United States?** B. Maynard, *Auto. Data Processing*, **2,** Dec. 1960, 12-15, 40, 42. Description by the leader of the European Productivity Agency's mission to study data processing installations in the U.S.A. of achievements and prospects in the U.S.A., some of the computer techniques used by Americans, how service centres are used, management education, and the role which government has played in encouraging research and development.

DESIGN

213 **Computer storage techniques.** G. A. Oliver, *Instr. & Control Systems*, **33,** Dec. 1960, 2070-2072. Introduction to a series of articles on digital computing storage technology. General properties of storage, different types of storage and types of access are explained and the characteristics of various storage systems are summarised. 4 refs.

214 **Computer switching with high-power transistors.** J. S. Ronne, *Electronics*, **33,** 4 March 1960, 44-47. This article discusses how to select the right power transistor and switching circuit to obtain required switching speed, gain and current-carrying capacity. Circuit design of a drive amplifier for a solid-state memory is given as an example. 3 refs.

215 **Control word expansion.** J. F. Dirac, *IBM Technical Disclosure Bull.*, **3,** Dec. 1960, 23. Brief description of arrangements for combining several control words into one expanded control word so as to increase the capabilities of computers having a comparatively short word length.

216 **Correction.** *IRE Trans. Electronic Computers*, **EC-9,** Dec. 1960, 509. Correction of typographical errors in "Conditional-sum addition logic", J. Sklansky, *ibid*, **EC-9,** June 1960, 226-231 (*C.A.*, **4,** Sept. 1960, Ref. 1633).

217 **Fast high-accuracy binary parallel addition.** H. C. Hendrickson, *IRE Trans. Electronic Computers,* **EC-9,** Dec. 1960, 465-469. The basic problem of parallel arithmetic unit design is achievement of high speed and high accuracy at low cost. This paper is concerned with the design of units which achieve higher accuracy by carrying more bits per operand. When the number of bits per operand is increased, one basic speed limitation is the time required to propagate carries in additions or borrows in subtraction. A quantitative method of evaluating the drastic reduction in time achieved by asynchronous addition techniques is described. 2 refs.

218 **Improvements to current switching.** F. K. Buelow, *IRE Trans. Electronic Computers,* **EC-9,** Dec. 1960, 415-418. This paper describes a circuit technique used to obtain logic blocks with delays under 5 mμsecs. The basic circuit concept consists of supplementing current switching circuits with diode switching circuits (thereby decreasing cost and increasing speed in comparison with an all current switching system) and emitter followers to drive the diodes. 2 refs.

219 **Manual clock controls.** R. J. Bahnsen, *IBM Technical Disclosure Bull,* **3,** Dec. 1960, 20-21. Brief description of an arrangement of manually controlled triggers which may be included in a large system maintenance console to provide four operation modes in addition to the normal clock operation. These modes are the distribution of only 1, 2 or 3 clock pulses or of every third clock pulse only.

220 **Microminiaturizing a space vehicle computer.** E. Keonjian, *Electronics,* **33,** 29 April 1960, 95-98. Account of microminiaturisation of a space vehicle digital computer using the two-dimensional technique, i.e. the placing of an entire functional circuit on a thin wafer substrate.

221 **Pneumatic computer research in the USSR.** R. N. Auger, *Auto. Control,* **13,** Dec. 1960, 43-48. Account, largely by way of captioned photographs, of developments in pneumatic computation technology at the Institute of Automatics and Telemechanics in Moscow. Equipment, described as being in the stage of advanced research, includes digital plug-in logic blocks, sub-miniature "airfoil" relays, diaphragm-and-nozzle plug-in analogue amplifiers, complex special purpose computers for optimising problems, and function generators.

222 **Procedure for designing reciprocal computer circuits.** A. Gill, *Electronics,* **33,** 20 May 1960, 92-93. This article concerns analogue computer circuits with outputs inversely proportional to inputs, which can be constructed from diodes, resistors and direct voltage supplies. Relationships between the element values of such circuits and the prescribed values of computation range and accuracy are presented.

223 **Pulsing magnetic matrices.** C. A. Andrews, *IBM Technical Disclosure Bull.,* **3,** Dec. 1960, 31. Brief description of a circuit which ensures coincidence of pulses supplied to a magnetic core matrix such as a decoder matrix.

224 **A secondary-emission pulse circuit, its analysis and application.** J. A. Narud, *IRE Trans. Electronic Computers,* **EC-9,** Dec. 1960, 439-451. This paper describes a regenerative pulse circuit using a single secondary-emission tube (Philips EFP 60) that is able to generate pulses having a rise time of 6 mμsec and a width continuously variable from 25 mμsec to 12 μsec. A theoretical discussion of the circuit is given in which expressions for pulse width and rise time are derived. Then, various practical realisations of the circuit are presented, including a millimicrosecond pulse generator and a fast pulse height discriminator. 11 refs.

225 **The simplification of multiple-output switching networks composed of unilateral devices.** G. C. Vandling, *IRE Trans. Electronic Computers,* **EC-9,** Dec. 1960, 477-486. It is shown in this paper that two-level (no more than two gates in cascade) multiple-output switching networks composed of unilateral switching devices such as diodes can be simplified or minimised in much the same manner as single-output networks. This is accomplished by extending the notation and techniques used in the simplification of two-level single-output switching networks to multiple-output switching networks. A simple procedure for identifying multiple-output prime implicants is devised and, as a final result, an algorithm is presented which can be used to minimise the switching network corresponding to a number of given Boolean expressions of the same variables. This algorithm is based on the Quine rules modified to take advantage of the so-called "don't care" conditions which occur because some inputs are forbidden or because some outputs are of no concern. 11 refs.

226 **A note on the Simultaneous-Carry-Generation system for high-speed adders.** M. Lehman and N. Burla, *IRE Trans. Electronic Computers,* **EC-9,** Dec. 1960, 510. Letter suggesting certain improvements to the Simultaneous-Carry-Generation system described by A. Weinberger and J. L. Smith (see, for example, "A one-micro-second adder using one-megacycle circuitry", *ibid,* **EC-5,** June 1956, 65-73). 5 refs.

227 **Solving noise problems in digital computer memories.** A. H. Ashley and E. U. Cohler, *Electronics,* **33,** 25 March 1960, 72-74. Describes how, in MOBIDIC, strobe pulses for read-out of coincident-current magnetic core matrices, are obtained directly from driven cores so as to overcome the problem of variations in driving circuits, temperature and waveforms. 2 refs.

228 **System application of hybrid logic circuitry.** J. T. Lynch and J. J. Karew, *IRE Trans. Electronic Computers,* **EC-9,** Dec. 1960, 418-423. This paper discusses design of circuits and systems employing hybrid transistor-diode logic technique in which either diodes or emitter follower transistors are used as gates and buffers to maximise the circuit performance rating (based on reliability and simplicity, input and output capabilities, propagation time, and cost). The technique combines the advantages of lumped and distributed gain circuits, and optimises the use of the transistor through non-saturating, low impedance circuitry. 12 refs.

229 **Tunnel diode logic circuits.** R. H. Bergman, *IRE Trans. Electronic Computers,* **EC-9,** Dec. 1960, 430-438. This paper is concerned with investigation of the use of tunnel diodes in logic and control portions of digital computers. Considerations of diode uniformity requirements, stability problems and power supply requirements has led to a monostable type of logical circuit. The switching properties of this circuit are analysed and found to depend on the negative resistance-capacitance time constant of the circuit. The basic function performed by the circuit is a thresholding operation from which a set of logical building blocks is derived. Compatible dynamic and bistable storage schemes are discussed. Of major importance is the effect of diode variations upon the logical gains and delays of the circuits.

230 **Research in microelectronics using electron-beam-activated machining techniques.** K. R. Shoulders, Stanford Research Institute, *PB 171027,* Sept. 1960, 216 p. Investigations into methods for obtaining electronic data processing systems of biological complexity indicate the feasibility of using over 10^{11} one-micron-sized active elements in a one-cubic-inch machine. An active element based upon the quantum mechanical tunneling of electrons from a metal into high vacuum is proposed that has an estimated switching time of 10^{-10} seconds; couples well to similar and accessory components; promises immunity to temperature variations; and seems adaptable to self-forming manufacturing methods giving component uniformity. Light detectors and generators and electrostatically operated electromechanical devices such as relays and filters seem to fulfil the requirements for accessory components. A micro document system would allow permanently stored data to be retrieved at a 10^{10} bit-per-second rate. A micromachining method for fabricating film materials is presented in which an electron beam is used to form a chemically resistant film on the material being machined, which is subsequently etched in vacuum by a molecular beam. This process has resolution capabilities of several hundred angstrom units. 85 refs.

231 **Error detection for coding circuits.** Int. Business Machines Corp., *B.P. 855940,* 14 Dec. 1960. A coding circuit for delivering a single output to a different output line in response to each possible pattern of energisation of input lines, has specified error detection arrangements. These arrangements are particularly intended to determine whether data residing in a memory address register has been properly translated to select the proper drive lines of a core memory.

232 **Magnetic core switching circuit.** Soc. d'Electronique et d'Automatisme, *B.P. 856444,* 14 Dec. 1960. This patent is concerned with a magnetic core switching circuit for the selective routing of current pulses between a common input and separate loads. In particular, the circuit can be used for controlling the writing and reading of magnetic core matrices.

233 **Zero testing in registers.** Int. Business Machines Corp., *B.P. 857047,* 29 Dec. 1960. A register is tested for the presence of a zero value by entering into each order pulses equal in number to the radix; carry pulses from each order are fed to an OR circuit, the output of which is supplied to a gating circuit operated in synchronism with the source of the pulses.

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234 **Decimal comparator.** Int. Business Machines Corp., *U.S.P. 2946983*, 26 July 1960. This patent describes a circuit employing AND, OR and Inverter circuits, for indicating the relative magnitude of two decimal inputs expressed in binary-decimal parallel by bit, serial by decimal digit order.

See also :—
Elements, Ref. 315.

LEARNING AND PATTERN RECOGNITION

235 **Characterizing experiments for finite-memory binary automata.** A. Gill, *IRE Trans. Electronic Computers*, **EC-9,** Dec. 1960, 469-471. The characteristics of a discrete automaton with a finite memory can be determined by an experiment of a finite length. This paper discusses the properties of such experiments and presents methods for their optimal construction. It is shown that the experiments can be viewed as sequential systems in their own right. 4 refs.

236 **Optimizers: their structure.** R. F. Wheeling, *Commun. ACM*, **3,** Dec. 1960, 632-638. In this paper optimisation is given a philosophical rather than mathematical presentation, the aim being to discover the structure of any optimizer. The dual relationship between optimizers and models is pointed out (the optimizer collects information about the system to be optimised so that a model of the system may be formed to guide the optimizer in its choice of actions) and a specific organisation (scheme) is presented which exploits this duality. Examples are used extensively to illustrate concepts, demonstrate the existence of certain phenomena, and exhibit specific optimising mechanisms. 7 refs.

237 **Pattern perception and learning programs.** L. Uhr, *Commun. ACM*, **3,** Nov. 1960, 597. Summary of research at the Mental Health Institute, University of Michigan on programming a machine to attempt to recognise visual patterns by decomposing them into what appear to be their natural basic (geometric) elements. 3 refs.

238 **Speech recognition.** W. S-Y. Wang, *Commun. ACM*, **3,** Nov. 1960, 598-599. Summary of research at the Communication Sciences Laboratory, University of Michigan, concerned with phonetic, instrumental and linguistic problems in the automatic recognition of the variety of English spoken by the educated male with the Midwestern American dialect. 20 refs.

239 **Statistical recognition functions and the design of pattern recognizers.** T. Marill and D. M. Green, *IRE Trans. Electronic Computers*, **EC-9,** Dec. 1960, 472-477. According to the model discussed in this paper, a pattern recognizer is said to consist of two parts: a receptor, which generates a set of measurements of the physical sample to be recognised, and a categorizer, which assigns each set of measurements to one of a finite number of categories. The rule of operation of the categorizer is called the "recognition function". The optimisation of the recognition function is discussed and the form of the optimal function is derived. In practice, a prohibitively large sample is required to provide a basis for estimating the optimal recognition function. However, if certain assumptions about the probability distributions of the measurements are warranted, recognition functions that are asymptotically optimal may be readily obtained. A small numerical example, involving the recognition of the hand-printed characters *A*, *B* and *C*, solved with an LGP 30 by means of the techniques described, is presented. 8 refs.

240 **Talking automaton.** E. v. Glasersfeld, *Commun. ACM*, **3,** Nov. 1960, 598. Summary of research at Milan University, Italy, directed towards the construction of a mechanical model capable of performing the human operations of perception, representation, mental categorisation, semantisation and speech. 4 refs.

241 **Computation, behavior, and structure in fixed and growing automata.** A. W. Burks, Michigan University, *PB 149486*, Oct. 1959, 40 p. Contents: Structure, behavior, and computation in fixed automata and generalized Turing machines; Analysis and synthesis of automata; Growing automata; Some problems with growing automata. 48 refs.

242 **Some mathematical fundamentals of the use of symbols in information retrieval.** C. N. Mooers, Zator Co., *PB 147541*, April 1959, 22 p. 10 refs. (This would appear to be the same as the paper given in *Information Processing*, 1960, 315-320—*C.A.*, **4,** Dec. 1960, Ref. 2348.)

243 **On the theory of process adaptive control systems, the learning model approach.** M. Margolis, California University, *PB 150252*, May 1960, 161 p. This dissertation attempts to extend the theory of feed-back control to those systems that operate in a widely changing environment. The particular method devised for determining the dynamic characteristics of the process makes use of a model, referred to as the learning model, and a mechanism for adjusting the parameters of the learning model. The model is an analogue of the process but with undetermined parameters. Both the model and the process are subjected to the same actuator signals. The response of the model is compared to the response of the process and the resulting error is used to activate the adjusting mechanism. It is the function of the adjusting mechanism to set the parameters of the model that the model will behave as much like the process as possible. The particular method for adjusting the parameters of the learning model is based on an approximation to the method of steepest descent. The equations describing the operation of the adjusting mechanism are derived and result in a nonlinear nonautonomous system. The stability and dynamic response of the learning mechanism are examined by both analytic methods and computer experiments. The learning mechanism was found capable of tracking the parameters describing the process for a wide variety of actuating signals. 31 refs.

244 **Character recognition.** Laboratory for Electronics, Inc., *B.P. 856342 & 856343*, 14 Dec. 1960. These two patents are concerned with apparatus which can be used for character recognition or similar purposes. According to *B.P. 856342*, an unknown signal waveform is classified by sampling at discrete intervals to derive signals each representing the difference between one of several known waveforms and the unknown, which signals are compared to ascertain the known waveform related to the signal representing the least difference. *B.P. 856343* concerns a digital-to-analogue converter employing magnetic cores and which is particularly suitable for use in the above described system.

245 **Character recognition.** Nat. Cash Register Co., *B.P. 856550*, 21 Dec. 1960. This patent is concerned with stylised characters which have different widths and one or more densely printed portions so as to produce distinctive electrical waveforms when sensed.

MATHEMATICS

246 **A note on approximating e^x.** S. Lubkin, *Commun. ACM*, **3,** Dec. 1960, 649. Brief note commenting on "Rapidly convergent expressions for evaluating e^{x}", A. Berin, *ibid*, **3,** Sept. 1960, 500 (*C.A.*, **4,** Nov. 1960, Ref. 2117), and suggesting that rapidly convergent expressions for e^x can be simply obtained by raising any approximation for $e^{x/n}$ to the nth power.

247 **Approximation of curves by line segments.** H. Stone, *Maths. of Computation*, **15,** Jan. 1961, 40-47. Most methods of linear and nonlinear programming have been designed to find the maximum or minimum value of a linear or nonlinear function inside a region bounded by hyperplanes. In applications of these methods it is often found that the formulation leads to constraints which are nonlinear. Thus, in gasoline blending problems the relationship between lead concentration and octane number of a blend (the lead susceptibility curve) has been found to be exponential in form. One method of dealing with such problems has been to approximate the given curves by a series of broken line segments. This paper is concerned with the problem of obtaining a best fit of broken line segments to a curve. The problem is formulated, a closed form solution when the given function is quadratic is presented, a general numerical method of solution (which has been programmed for the IBM 704) is given, and this numerical procedure is applied to the lead susceptibility curve.

248 **A bibliography on approximate integration.** A. H. Stroud, *Maths. of Computation*, **15,** Jan. 1961, 52-80. A bibliography, containing in the region of 450 references, with the main emphasis on recent papers concerning approximate integration methods. The two main subjects are quadrature (or numerical integration) formulas—weighted linear sums of values of the integrand (and possibly derivatives of the integrand)—and finite difference approximations. The references are listed in alphabetical order of authors and are not annotated or indexed as to subject.

249 **Evaluation of the incomplete gamma function of imaginary argument by Chebyshev polynomials.** R. Barakat, *Maths. of Computation,* **15,** Jan. 1961, 7-11. This paper presents a method of evaluating the incomplete gamma function of imaginary argument using expansion into a series of Chebyshev polynomials instead of into a Taylor series. 7 refs.

250 **Improved formulas for complete and partial summation of certain series.** H. E. Salzer and G. M. Kimbro, *Maths. of Computation,* **15,** Jan. 1961, 23-39. In earlier papers, Salzer has presented formulas for summing a series either to infinity (complete) or up to a certain number n of terms (partial) by considering the sum of the first j terms S_j, or some suitable modification, S'_j, closely related to S_j, as a polynomial in $1/j$. Either S_∞ or S_n was found by m-point Lagrangian extrapolation from S_{j0}, S_{j0-1}, . . . ,S_{j0-m+1} to $1/j=0$ or $1/j=1/n$ respectively. The present paper furnishes more accurate m-point formulas for sums (or sequences) S_j which behave as even functions of $1/j$. Tables of Lagrangian extrapolation coefficients in the variable $1/j^2$ are given for: complete summation, $m=2(1)7$, $j_0=10$, exactly and 20D, $m=11$, $j_0=20$, 30D; partial summation, $m=7$, $j_0=10$, $n=11(1)25(5)100,200,500,1000$, exactly. Applications are made to calculating π or the semi-perimeters of many-sided regular polygons, Euler's constant, Catalan's constant, calculation of a definite integral as the limit of a suitably chosen sequence, determining later zeros of $J_\nu(x)$ from earlier zeros for suitable ν, etc. A useful device in many cases involving sums of odd functions, is to replace S'_j by a trapezoidal-type S'_j which is seen, from the Euler-Maclaurin formula, to be formally a series in $1/j^2$. 13 refs.

251 **Least squares fitting of a great circle through points on a sphere.** L. de Witte, *Commun. ACM,* **3,** Nov. 1960, 611-613. Describes a procedure for solution of a problem which is stated as follows: "Assume that a number of points $P(x_i,y_i)$ on a sphere, described by longitude x and latitude y (or the angles ϕ and θ in a spherical coordinate system), fall approximately along a great circle. Find the great circle that minimizes the sum of the squares of its distances on the surface of the sphere to the points $P(x_i,y_i)$ over the entire set of points."

252 **New factors of Mersenne numbers.** E. Karst, *Maths. of Computation,* **15,** Jan. 1961, 51. Nineteen new prime factors of Mersenne numbers are presented; these were found by testing for prime factors all the Mersenne numbers 2^p-1 corresponding to prime exponents p in the interval $3000<p<3500$. 2 refs.

253 **New tables of Howland's and related integrals.** C. W. Nelson, *Maths. of Computation,* **15,** Jan. 1961, 12-18. Tables of Howland's integrals to 18D are presented and their use in evaluating related integrals is explained. 11 refs.

254 **Numerical integration using sums of exponential functions.** F. C. Ledsham, *Maths. of Computation,* **15,** Jan. 1961, 48-51. Brief note presenting analytical formulae for obtaining coefficients required when effecting numerical integration using sums of exponential functions. 3 refs.

255 **Two theorem tables of matrix algebra.** G. C. Best, *Maths. of Computation,* **15,** Jan. 1961, 19-22. This paper shows how it is possible, by a slight modification of the mode of presentation, to state many of the theorems of matrix algebra in table form.

TECHNIQUES

256 **An algorithm for the assignment problem.** R. Silver, *Commun. ACM,* **3,** Nov. 1960, 605-606. The assignment problem is formulated as follows: "Given an $n\times n$ matrix (d_{ij}) of real numbers, find a permutation x of the integers $1 \ldots n$ that minimizes $\sum_{i=1}^{n} d_{ixi}$. That is for any permutation y of the integers $1 \ldots n$, we have $\sum_{i=1}^{n} d_{ixi} \leqq \sum_{i=1}^{n} d_{iyi}$." This problem is briefly discussed and, in Ref. 257 (27), an algorithm is presented. An empirical relation between solution time and the size of the problem is given. 3 refs.

257 **Algorithms.** *Commun. ACM,* **3,** Nov. 1960, 600-604. Details in ALGOL 60 of the following (with ACM serial number):

21. **Bessel function for a set of integer orders.** W. Borsch-Supan, p. 600. Computes the values of the Bessel functions $J_p(x)$ for real argument x and the set of all integer orders from 0 up to n and stores these values into the array J, whose subscript bounds should include the integers from 0 up to n.
22. **Riccati-Bessel functions of first and second kind.** H. Oser, p. 600-601. Computes $S_k(x)=(\pi x/2)^{\frac{1}{2}} J_{k+\frac{1}{2}}(x)$ and $C_k(x)=-(\pi x/2)^{\frac{1}{2}} Y_{k+\frac{1}{2}}(x)$ for real $x \neq 0$ and all integer values of k from 0 through n with a prescribed (absolute) accuracy.
23. **MATH SORT.** W. Feurzeig, p. 601. A fast sorting algorithm which produces a monotone rearrangement of an arbitarily ordered set of numbers.
24. **Solution of tri-diagonal linear equations.** B. Leavenworth, p. 602. Finds the solution of an $n\times n$ system of linear equations whose matrix is in tridiagonal form, that is, $a_{ij}=0$ for $|i-j| \geqq 2$.
25. **Real zeros of an arbitary function.** B. Leavenworth, p. 602. Finds the real zeros of an arbitary function using Muller's method.
26. **Rootfinder III.** J. G. Herriot, p. 603. Computes a value of $g=y$ satisfying the equation $y=f(y)$. (Preceded by **Remark on Algorithm 15 Rootfinder II,** G. E. Forsythe and J. G. Herriot, p. 602.)
27. **Assignment.** R. Silver, p. 603-604. See Ref. 256.
28. **Least squares fit by orthogonal polynomials.** J. G. Mackinney, p. 604. Accepts m values of the function f at equal intervals of the abscissa from xl through xm, and obtains in p[0] through p[k] the coefficients of the best polynomial approximation of degree k or less (least squares).
29. **Polynomial transformer.** J. G. Mackinney, p. 604. Computes coefficients d0, dl, . . . , dn of the transformed polynomial p(t) given c0, cl, . . . , cn of p(x) where $x=at+b$.

258 **Algorithms.** *Commun. ACM,* **3,** Dec. 1960, 643. Details in ALGOL 60 of the following (with ACM serial number):

30. **Numerical solution of the polynomial equation.** K. W. Ellenberger. See Ref. 271.

259 **Analogue computer techniques. Part 2. An approximate method for the solution of partial differential equations.** F. C. Harbert, *Electronic Engng.,* **32,** March 1960, 166-167. For "Part 1. The solution of simultaneous equations, eigenvalue problems and polynomial equations." See *ibid,* **32,** Feb. 1960, 74-77 (*C.A.,* **4,** July 1960, Ref. 1181). Part 2 describes a method for obtaining approximate solutions of partial differential equations by finite difference techniques. See also Ref. 260.

260 **Analogue computer techniques. Part 3. The simulation of transportation delay and its use in control systems.** F. C. Harbert, *Electronic Engng.,* **32,** March 1960, 167-169. For Parts 1 and 2 see Ref. 259. Part 3 presents different computer arrangements required to simulate transportation delay using the Padé approximations.

261 **Character scanning on the IBM 7070.** A. E. Speckhard, *Commun. ACM,* **3,** Nov. 1960, 622. A general requirement in the construction of symbol manipulators and automatic programming systems is the need to scan a line of information, usually from left to right, and to break down or subdivide this line into words, phrases or some form of subgrouping. This note briefly discusses character scanning on the IBM 7070 which has several features making it possible to scan a line with particular efficiency and without resorting to separating the line into individual characters.

262 **Note on eigenvalue computation.** J. F. Andrus, *Commun. ACM,* **3,** Nov. 1960, 617. This note presents a simple Lemma, containing the fundamental point of the method of unitary triangularisation, which has been used as a "jack-of-all-trades" in a relatively short program for determining all eigenvalues and eigenvectors of complex matrices. 3 refs.

263 **An estimation of the relative efficiency of two internal sorting methods.** H. Nagler, *Commun. ACM*, **3,** Nov. 1960, 618-620. This paper is concerned with the IBM 705, models I and II, and presents a study of the machine time required by two internal sorting methods—the conventional two-way merge and a form of the binary search. Estimates are derived for the more time-consuming operations of comparison of keys, loading of keys into accumulator storage and transmission of tags. A table is presented which enables a best sorting method to employ in a particular case to be deduced.

264 **Fibonaccian searching.** D. E. Ferguson, *Commun. ACM*, **3,** Dec. 1960, 648. A method of searching an ordered list for a given argument, which conserves both space and time is described. In this method, which utilises the Fibonacci numbers defined by

$$u_i = i, \qquad i < 2$$
$$u_i = u_{i-1} + u_{i-2}, \quad i \geqq 2,$$

successive increments are found by subtraction.

265 **Letter to the Editor.** R. Silver, *Commun. ACM*, **3,** Dec. 1960, A9. Letter comparing various rounding-off procedures and discussing how a procedure may be chosen to reduce the growth of round-off error in a particular case.

266 **A method for overlapping and erasure of lists.** G. E. Collins, *Commun. ACM*, **3,** Dec. 1960, 655-657. An important property of the Newell-Shaw-Simon scheme for computer storage of lists is that data having multiple occurrences need not be stored at more than one place in the computer, i.e. the lists may be "overlapped". However, overlapping poses a problem for subsequent erasure—given a list that is no longer needed, it is required to erase just those parts that do no overlap other lists. This paper describes a general method which enables efficient erasure by the arbitary interspersion in lists of words containing reference counts which describe the extent of the overlapping. 5 refs.

267 **Multiple precision arithmetic.** D. A. Pope and M. L. Stein, *Commun. ACM*, **3,** Dec. 1960, 652-654. This note presents a representation of multiple precision numbers which make it easy to consider high precision arithmetic for arbitary values of the precision without basing the discussion on special properties of any specific piece of equipment. Thus, n-tuple precision arithmetic is viewed as the arithmetic of n digit integers in the β number system where β is related to the geometry of the machine in such a way that the single precision components present β digits. A multiple precision algorithm for division is analysed to illustrate the ease with which this point of view can be applied. 14 refs.

268 **A new technique for analog integration and differentiation.** M. A. Thomae, *IRE Trans. Electronic Computers*, **EC-9,** Dec. 1960, 507-509. A technique is described which enables an approach to ideal analogue integration or differentiation by means of passive elements only. A series of RC circuits in a cascade arrangement, uncoupled to each other, provides the first, second, third, etc., integrals or derivatives of the input function. The theory establishes that if the outputs of the circuits are fed to an analogue summing amplifier, its output becomes arbitarily close to the ideal integral or derivative of the input function as the number of RC stages is raised indefinitely.

269 **Over-all computation control and labelling.** A. Holt, *Commun. ACM*, **3,** Nov. 1960, 614-615. This paper discusses the advantages of and presents some proposals for the structure of a uniform set of labelling conventions for all informational entities (such as programs, data sets, etc.) that stream in and out of a computer. Such a labelling system is required in particular for a general operator program which operates special service programs for such functions as machine program generation, correction of data or programs, verification, editing of input and output, operating, i.e. accomplishing the transition from one run to the next, and filing new routines or data sets. 5 refs.

270 **Programmed error correction in Project Mercury.** B. Dimsdale and G. M. Weinberg, *Commun. ACM*, **3,** Dec. 1960, 649-652. This paper is concerned with the problem of error when using a digital computer in real time control, with particular reference to Project Mercury—man in space. After pointing out that tape operations are an important source of error, a description is given of how a Hamming (error correcting) code was used on tapes in order that the program itself might automatically correct all of the most probable errors in tape reading operations. 2 refs.

271 **On programming the numerical solution of polynomial equations.** K. W. Ellenberger, *Commun. ACM*, **3,** Dec. 1960, 644-647. This paper is concerned with the algorithm given in Ref. 258 for computing the roots of polynomial equations. A technique giving a high degree of accuracy and rapid convergence is provided by combining the Bairstow and Newton iterative methods. Descriptions are presented of the Newton and Bairstow iterations, selection of the first approximations, reasons for using a simultaneous Bairstow and Newton iteration, and the criterion for deciding whether to substitute variables. The steps in the solution of equations are summarised and a sample solution of a quartic is given.

272 **A simple technique for coding differential equations.** P. Sefton and R. Vaillancourt, *Commun. ACM*, **3,** Nov. 1960, 616-617. A program that will solve an arbitary system of first order differential equations may be considered as a main program which performs the operations of input-output, initialisation, choice of step size and actual solution of the equations and a subsidiary program or subroutine which evaluates the derivatives according to the given functional relationships. Such a subroutine has to be written for each new system of equations. This paper describes a procedure, developed at the University of Ottawa, for minimising the time and effort required to prepare a given system of equations for numerical solution. The procedure makes it possible to write the differential equations in FORTRANSIT language and to use the FORTRANSIT compiler for the IBM 650 to prepare the detailed coding; the roles of the main program and subroutine are reversed so that the main program is prepared and used as a compiler subroutine. 2 refs.

273 **The simulation of transfer functions on an analogue computer.** F. C. Harbert, *Electronic Engng.*, **32,** June 1960, 354-355. Describes a one-amplifier circuit for performing the operation of double integration and a method of synthesizing polynomial transfer functions on an analogue computer.

274 **Solving integral equations on a repetitive differential analyzer.** R. Tomovic and N. Parezanovic, *IRE Trans. Electronic Computers*, **EC-9,** Dec. 1960, 503-506. This paper discusses the practical solution of integral equations using a general purpose repetitive differential analsyer which fulfills certain, readily obtained requirements, without complex auxiliary equipment. 8 refs.

275 **Two methods for word inversion on the IBM 709.** R. A. Price; P. D. Jardins, *Commun. ACM*, **3,** Dec. 1960, 658. Two methods are given for rapidly inverting 36-bit binary words by use of the IBM 709/7090 CAQ or convert instruction.

276 **Uniqueness of weighted code representations.** G. P. Weeg, *IRE Trans. Electronic Computers*, **EC-9,** Dec. 1960, 487-489. One class of binary-coded decimal digits which may be used in decimal computers is the so-called four-bit weighted code representation with weights $w_1\ w_2\ w_3\ w_4$. Each w_i is a nonzero integer in the range $-9 \leq w_i \leq 9$, and the set of weights must have the property that every decimal digit can be represented by the sum

$$\sum_{i=1}^{4} b_i\, w_i$$

with the b_i being 0 or 1. For some weighted codes the weights are such that some digits can be represented by more than one sum of the specified form. For example, the 7421 weighted code has the property that 7 may be represented either as 1000 or 0111. In this paper a necessary and sufficient condition on the weights of a weighted code is derived for the unique representation of each digit by a sum of the form specified above. All possible sets of weights, determined on the MISTIC computer, are given. 2 refs.

See also :—
Learning and Pattern Recognition, Ref. 236.
Mathematics, Refs. 246, 251.

ACCESSORIES

277 **Circuit for detecting errors.** R. A. Boennighausen, *IBM Technical Disclosure Bull.*, **3,** Dec. 1960, 30. Brief description of a transistor circuit for use in error detection in magnetic recording and which senses the transient voltage across the write coil and permits checking the write flux variation against the write amplifier input during the write period.

278 **An eight digit word generator using surface barrier transistors and direct coupled technique.** P. L. Owen and T. R. H. Sizer, *Electronic Engng.*, **32**, March; April 1960, 134-139; 212-217. This article is concerned with a binary word generator built as a piece of test equipment for the subsequent development of digital computer elements. A brief explanation of serial and parallel operation leading to the concept of serial word representation, is followed by a logical description of a serial word generator. Direct coupled technique using surface barrier transistors is described and an account is given of transistorised logic elements. The word generator, which provides digital representation in serial form of any two numbers between 2^8-1 and zero, is then described in some detail. 4 refs.

279 **First alarm indicator.** J. R. Wood. *IBM Technical Disclosure Bull.*, **3**, Dec. 1960, 18-19. Several indications or alarms of errors detected in a digital computer may occur before remedial action can be taken. This disclosure briefly describes logic for determining the identity of the first alarm and which establishes which instruction was being processed at the time the alarm occurred and the time pulse at which the alarm occurred.

280 **Limit stop circuitry for servo.** R. A. Schulz. *IBM Technical Disclosure Bull.*, **3**, Dec. 1960, 42-43. Brief description of a limit stop control circuit for a digital computer-controlled servomechanism featuring servo disconnect at the limit stop and automatic reset.

281 **Magnetic drum recorder assembly.** L. J. Poch and G. L. Wiederhold. *IBM Technical Disclosure Bull.*, **3**, Dec. 1960, 7-8. Brief description of the mechanism of a magnetic data recording system in which a stationary head reads or records data on endless magnetic tape wrapped around the surface of a rotatable drum and carried by reels within the drum.

282 **Novel tape transport mechanism.** *Instrument Practice*, **14**, Dec. 1960, 1303-1304. Description of a magnetic tape transport mechanism intended primarily for use with the RADIC (Redifon Analogue-Digital Computing) system. The mechanism moves 35 mm. tape with sprocket holes in discrete, intermittent steps during recording and readout. The tape has 16 tracks on which data can be recorded in binary form, one track for each binary order up to 2^{15}. A pulse which is applied to a stepping motor to advance the tape one step is also applied to a decimal-to-binary converter to cause it to supply binary data to recording heads.

283 **Practical methods of analogue-to-digital conversion.** R. I. Ostler. *Instrument Practice*, **14**, Dec. 1960, 1305-1312. This article describes and discusses the circuit design of analogue-to-digital converters or digitisers of the time encoding and self-balancing feedback types. 5 refs.

284 **Program controlled drum erase.** J. A. Raymond. *IBM Technical Disclosure Bull.*, **3**, Dec. 1960, 16. Brief description of circuitry responsive to either a program or manual command to energise a long bar-shaped electromagnet with a decreasing alternating current to effect complete erasure of a drum.

285 **Recent developments in data communications.** *Auto. Control*, **13**, Dec. 1960, 38-39. Brief, illustrated accounts of Data-Phone (Bell Systems), Autofax (Communications Control Corporation), and Dial-o-verter (Digitronics Corporation).

286 **Record converter.** R. L. Taylor. *IBM Technical Disclosure Bull.*, **3**, Dec. 1960, 9-10. Brief description of a system consisting of a punched paper tape reader, a translator and a magnetic tape writer which includes devices for controlling the flow of converted data in an orderly fashion during periods of acceleration and deceleration of the tapes as well as during periods of synchronous operation.

287 **Survey of coded character representation.** R. W. Bemer. *Commun. ACM*, **3**, Dec. 1960, 639-641. The codes for character set representation in paper tape, magnetic tape and main storage used in more than 50 commercial equipments are presented in chart form as an aid to the deliberations of the American Standards Association Sub-Committee X3.2 on character sets and data format. See also Ref. 288.

288 **Survey of punched card codes.** H. J. Smith and F. A. Williams. *Commun. ACM*, **3**, Dec. 1960, 638, 642. A survey, similar to that of Ref. 287, is given of more than 20 punched card codes.

289 **Magnetic tape system.** Sperry Rand Corp., *B.P. 855712*, 7 Dec. 1960. This patent is concerned with a system for reading data from parallel tracks on magnetic tape with skew compensation by applying the output from each track to a shift register which is controlled by signals from a pair of spaced control tracks.

290 **High-speed printer.** Int. Business Machines Corp., *B.P. 855834*, 7 Dec. 1960. In a high-speed printer, an electro-adhesive clutch establishes a drive to a printing hammer to propel it towards a record medium fed between the hammer and a continuously rotating cylinder which has a helical printing surface.

291 **Cathode ray tube printer.** Int. Business Machines Corp., *B.P. 855941*, 14 Dec. 1960. This patent describes a lamp control circuit, particularly intended for a flashing lamp which records a page outline in a cathode ray tube printer, which should the lamp fail to ignite effects repeat operations until the lamp ignites.

292 **Code converter.** Nat. Cash Register Co., *B.P. 856924*, 14 Dec. 1960. A code converter, which may be used for digital computer input, converts characters represented in any one of several codes into a common code and employs a magnetic core matrix.

293 **Magnetic data recording.** Ampex Corp., *B.P. 856300*. 14 Dec. 1960. A magnetic head for recording digital data by the non-return-to-zero method is excited by a bistable bridge, the circuit of which is specified in this patent.

294 **Data transfer.** Int. Business Machines Corp., *B.P. 856303*. 14 Dec. 1960. Data transfer apparatus in which sensing means for each index position of, for example, punched cards, supply data to an associated position of an intermediate store from which data is transferred to a corresponding position of a main store between sensing of successive index positions.

295 **Reading magnetic record cards.** Int. Business Machines Corp., *B.P. 856755*, 21 Dec. 1960. Reading apparatus for magnetic marks on record cards, comprises a magnetic core with a winding exhibiting different values of inductance according to whether or not a mark is present at a gap in the core, the winding being included in a filter circuit.

296 **Tape drive.** Int. Business Machines Corp., *B.P. 856944*, 21 Dec. 1960. Magnetic or other data storing tape is driven by a fluid motor in a fluid circuit which includes a valve, which valve is controlled by a second fluid circuit including a pilot valve controlled by electrical signals.

297 **Mounting of heads for a magnetic drum.** Electric & Musical Industries Ltd., *B.P. 857272*, 29 Dec. 1960. This patent is concerned with mounting arrangements for the heads of a magnetic drum data store, which permit adjustment of heads in a direction parallel to the drum axis, towards and away from the drum and also so that the heads are equidistant from the drum.

298 **Random access store.** Int. Business Machines Corp., *B.P. 857284*, 29 Dec. 1960. A random access data store in which data records are stored on different circular tracks of a magnetic disc, each new record replacing an old record and beginning at any random position along the track.

299 **Data transfer.** Int. Business Machines Corp., *B.P. 857301*, 29 Dec. 1960. Data transfer to or from selected, serially scanned positions of a storage medium is controlled by a counter settable to the initial position involved, a gating signal being initiated and terminated in response to given conditions of the counter.

300 **Magnetic recording of data.** Int. Business Machines Corp., *B.P. 857313*, 29 Dec. 1960. This patent describes circuit arrangements for detecting a change in sign of the slope of a waveform, such as the output of a magnetic reading head. A transistor circuit causes a capacitor to be charged in opposite directions according to the direction of the change in sign.

301 **Magnetic drums.** Int. Business Machines Corp., *B.P. 857328*, 29 Dec. 1960. Data storage apparatus, especially a magnetic drum, in which a record surface supporting element yields under forces accompanying the motion of the element to urge the element to a recording position.

302 **Analogue-to-digital converter.** Soc. Nouvelle d'Electronique, *B.P. 857510*, 29 Dec. 1960. This patent is concerned with the design of an analogue-to-digital converter of the time encoding type to increase the accuracy.

303 **Data transfer.** Curtiss-Wright Corp., *U.S.P. 2944248*, 5 July 1960. Apparatus for detecting and correcting errors in the transfer of data from a magnetic or other tape to a store.

304 **Data conversion apparatus.** Burroughs Corp., *U.S.P. 2944733*, 12 July 1960. This patent is concerned with apparatus for translating data from a standard punched card to binary-coded or similar digital pulse form with the aid of magnetic drum buffer.

305 **Magnetic core storage system.** Int. Business Machines Corp., *U.S.P. 2946985*, 26 July 1960. A buffer store employing magnetic cores is designed for asynchronous reading and writing.

306 **Data transmission.** Int. Business Machines Corp., *U.S.P. 2946986*, 26 July 1960. A digital data communications system in which a transmission channel is connected to several receivers and "party line" operation is effected by means of digital, receiver-identifying signals.

See also :—
Applications, Miscellaneous, Ref. 401.

ELEMENTS

307 **Analog representation of Poisson's equation in two dimensions.** R. J. Martin, N. A. Masnari and J. E. Rowe, *IRE Trans. Electronic Computers*, **EC-9,** Dec. 1960, 490-496. This paper is concerned with a new analogue device, called a Poisson cell, which has been developed to assist in obtaining solutions to either Laplace's equation or Poisson's equation. The cell, which has applications in the fields of hydrodynamics, heat conduction and aerodynamics, may be used to simulate electric, magnetic and gravitational potentials and the velocity potential of irrotational flow. The cell is a solid volume-conducting medium made from a homogeneous mixture of hydrostone and graphite. Electrode configurations may be painted on the surface with conducting paint or imbedded directly in the structure. In the case of Poisson's equation, where $\nabla^2 \phi (x, y) = f(x, y)$, the function $f(x, y)$ is simulated by injecting currents into the underside of the cell. Application of the Poisson cell, particularly to problems in electron flow, is discussed in detail together with the incorporation of the cell into either analogue or combined analogue-digital computer systems. 7 refs.

308 **Bidirectional counter stage.** D. E. Norton, *IBM Technical Disclosure Bull.*, **3,** Dec. 1960, 22. Brief description of a fast counter stage which provides addition or subtraction carry pulses with only one logical level delay per stage.

309 **Boosting function generator output with transistors.** D. R. Chick, *Electronics*, **33,** 25 March 1960, 75-76. Description of function generator circuit using transistors instead of diodes so that amplification of output is not necessary.

310 **Current build-up in avalanche transistors with resistance loads.** D. J. Hamilton, *IRE Trans. Electronic Computers*, **EC-9,** Dec. 1960, 456-460. In this paper a transient analysis for the avalanche transistor is carried out through the use of a diffusion model described in terms of charge variables. Basically, the current as a function of time is calculated by taking the gradient of the minority carrier charge stored in the base region. Two methods of approximating the distribution of stored charge are described. A practical pulse generator circuit is described in which the resistance load takes the form of a delay line.

311 **Current gain storage.** J. L. Anderson, *IBM Technical Disclosure Bull.*, **3,** Dec. 1960, 40. Brief description of a superconductor persistent current circuit formed by four paths arranged so that there are six persistent current loops, a control conductor being provided with a control section arranged adjacent each path.

312 **Data latch.** M. E. Homan, *IBM Technical Disclosure Bull.*, **3,** Dec. 1960, 27-28. Brief description of a data latch circuit whereby the voltage level of a data signal line is held constant and is not subject to variations at a data input terminal during the time that a latch control signal is applied.

313 **Disc type cryotron.** A. E. Brennemann, *IBM Technical Disclosure Bull.*, **3,** Dec. 1960, 41. Brief description of a disc type cryotron in which the magnetic field and current density of the gate are related to the geometry.

314 **An electrically alterable nondestructive twistor memory.** R. L. Gray, *IRE Trans. Electronic Computers*, **EC-9,** Dec. 1960, 451-455. This paper first discusses the basic principles of twistor operation and shows how a twistor memory array may be fabricated. A nondestructive method of reading a twistor memory by use of multiple solenoids is then described. 9 refs

315 **Esaki diode logic circuits.** G. W. Neff, S. A. Butler and D. L. Critchlow, *IRE Trans. Electronic Computers*, **EC-9,** Dec. 1960, 423-429. By proper biasing and loading, the Esaki diode can be used to perform power amplification and memory functions. In this paper various digital computer circuits are described which utilise these properties, including the following: (1) A shift register having one Esaki diode and one conventional diode per stage. Shifting is accomplished with a two-phase square-wave drive. The Esaki diode provides memory and power gain and the conventional diode provides a unilateral flow of information. (2) A shift register which combines Esaki diodes (for memory and power gain) with square-loop magnetic cores which, upon application of a single-phase drive, perform a gating operation depending on the state of the diodes. (3) High speed circuits using Esaki diodes primarily for memory and transistors for power gain and unilateral flow of information. (4) A binary counter using Esaki diodes with magnetic cores. (5) High speed flip-flops using Esaki diode-transistor combinations.

316 **Expandable random access memories.** G. E. Lund and D. R. Faulis, *Electronics*, **33,** 11 March 1960, 164-166. Description, with circuit diagrams, of plug-in, magnetic core memory packages used in the Burroughs B-251 Visible Record Computer.

317 **Fast switching inverter.** K. M. Trampel, *IBM Technical Disclosure Bull.*, **3,** Dec. 1960, 26. Brief description of a circuit, employing two NPN and one PNP transistors, which inverts an input signal and is capable of switching a large current output at a rapid rate.

318 **High-speed transistorized adder for a digital computer.** F. Salter, *IRE Trans. Electronic Computers*, **EC-9,** Dec. 1960, 461-464. An adder is described that has been developed for the Floating Indexed Point Arithmetic Unit, FLIP, to be used in conjunction with GEORGE, the existing computer at Argonne National Laboratory. The logic of the high speed adder and the special circuits required are presented. The adder is parallel and its high speed is made possible by reducing the carry propagation time. Each bit of the adder contributes one transistor to make up a tall AND gate which reduces the carry propagation time to 0.2 μsec. Using this high speed carry propagation and RCTL circuitry it is possible to complete an addition in less than 0.25 μsec. 3 refs.

319 **Making Esaki diodes.** F. H. Dill, *IBM Technical Disclosure Bull.*, **3,** Dec. 1960, 25. Brief description of the making of Esaki junctions by the alloying into degenerate p-type gallium arsenide of germanium in a suitable carrier metal such as gold.

320 **Measurement of diode switching characteristics.** W. S. Eckess and P. G. Ducker, *Electronics*, **23,** 8 April 1960, 59-61. This article describes the measurement of forward and reverse recovery times of semiconductor computer diodes, using a very fast rise time mercury relay pulse generator and a sampling oscilloscope with an equivalent bandwith of more than 1,000 Mc/s. 2 refs.

321 **A new, solid-state, nonlinear analog component.** L. D. Kovach and W. Comley, *IRE Trans. Electronic Computers*, **EC-9,** Dec. 1960, 496-503. This paper is concerned with a passive nonlinear device which when used with operational amplifiers enables a large class of functions to be obtained. The device makes use of the varistor and a basic varistor squaring unit, called the Quadratron, compensated for the various errors inherent in the varistor, is described. The application of the Quadratron is discussed for the basic operations of squaring and extracting square roots, for obtaining the square root of a sum of squares and for multiplication, and for generating functions such as exponent, sine, cosine, tangent, hyperbolic cosine and hyperbolic tangent. 3 refs.

322 **Parametric amplifier.** R. W. Landauer, *IBM Technical Disclosure Bull.*, **3,** Dec. 1960, 35. Brief description of a parametric amplifier comprising a ferroelectric crystal having high nonlinear capacitance and on which four electrodes are mounted. Three electrodes each form with the fourth a transmission line and the three transmission lines handle respectively the pump, signal and idling frequencies.

323 **Parametron computer circuits.** K. Nagamori, *Electronics*, **33**, 3 June 1960, 73-78. After a discussion of the characteristics and coupling of parametrons, brief descriptions are given of circuits for: AND element; OR element; NOT element; shift register; half adder; full adder; serial adder; parallel adder; high-speed carry adder; multiplier; counter; reversible counter; code converter; and input-output translator.

324 **Photologic memory.** W. K. French, *IBM Technical Disclosure Bull.*, **3**, Dec. 1960, 36-37. Description of an arrangement comprising an electroluminescent-photoconductive translator, a selection network and a perforated memory card, providing tag memory functions as well as fully associative memory functions.

325 **Single shot amplifier.** R. W. Landauer, *IBM Technical Disclosure Bull.*, **3**, Dec. 1960, 34. Brief description of two modes of operation to obtain single shot type parametric amplification with a transmission line formed by a ferroelectric crystal exhibiting a high degree of non-linear capacitance and on which two electrodes are mounted.

326 **Stored current bias.** J. L. Anderson, *IBM Technical Disclosure Bull.*, **3**, Dec. 1960, 38-39. Brief description of a superconductor persistent current circuit formed by four paths arranged so that there are six persistent current loops, control conductors being provided adjacent three of the paths, and which can be designed to function as an OR, Majority or AND circuit.

327 **Transmission line parametric amplifier.** G. R. Holzman, *IBM Technical Disclosure Bull.*, **3**, Dec. 1960, 33. Brief description of parametric amplifiers employing transmission lines having variable reactance. The transmission lines have a common dielectric and coupling is produced between the pump signal and the signal to be amplified through the interaction of the signals in the dielectric.

328 **Tunnel diode memory package.** W. W. Lawrence, *IBM Technical Disclosure Bull.*, **3**, Dec. 1960, 29. Brief description of a memory cell package for use with a matrix composed of microstrip transmission line elements.

329 **Current induced switching of superconductive thin films.** F. W. Schmidlin, A. J. Learn, E. C. Crittenden and J. N. Cooper, Space Technology Labs., Inc., *PB 150042*, 15 June 1960, 30 p. Currents required to cause superconducting to normal transitions of thin films have been measured as a function of temperature for various widths and thicknesses. Normal to superconducting transition times for the same films have also been measured as a function of the magnitude of drive current. In spite of the lack of a satisfactory theoretical model for the initiation of the transition the bulk of the results can be understood in terms of temperature changes in the films, as governed by factors limiting the flow of heat (generated subsequent to the initial transition) into the substrate and liquid helium bath. 4 refs.

330 **The preparation and characteristics of thin ferromagnetic films.** Remington Rand Univac Division, Sperry Rand Corp., *PB 150211*, May 1960, 39 p. The results are given of an experimental study of the magnetic properties of thin films prepared by chemical methods. Electrodeposition in aqueous solutions and thermal decomposition of carbonyl vapours have shown very encouraging results. Electrodeposited ferromagnetic nickel-iron films having thicknesses in the range 2500 to 3000 Å give reproducible results when a glass substrate is used onto which a conductive layer of gold is sputtered. Films deposited on Mylar having a conductive layer of evaporated chromium and copper also give good magnetic properties. Films produced by thermal decomposition of carbonyl mixtures do not as yet show comparable magnetic or switching properties. 8 refs.

331 **Data storage apparatus.** Hydel, Inc. *B.P. 855583*, 7 Dec. 1960. In apparatus for storing data, more particularly with the use of photo-electric techniques, images are produced of successive rows of a two-dimensional array of data and presented successively to a row of image-responsive transducers.

332 **Electro-optical logic element.** Soc. d'Electronique et d'Automatisme, *B.P. 855732*, 7 Dec. 1960. A data processing device for effecting logical operations on binary data, comprises an electroluminescent member optically coupled to a photo-resistive member.

333 **Pulse generator.** Int. Business Machines Corp., *B.P. 858877*, 7 Dec. 1960. Pulses, which may be used for the control of data transfer between two memories, are produced by chains of cascade-connected bistable triggers, each chain being operated by phase-displaced pulses and a trigger in one chain being interconnected with a trigger in another chain.

334 **Gate with memory properties.** Philips Electrical Industries, Ltd., *B.P. 856014*, 14 Dec. 1960. A gating device with memory properties comprises a soft magnetic core with considerable remanence and a plate having magneto-electric transmission properties.

335 **Magnetic core matrix.** Olympia Werke A.-G., *B.P. 856350*, 14 Dec. 1960. Each core in a matrix is threaded by writing and reading wires and each wire is connected to corresponding row and column conductors with which the particular core is associated and is provided with a diode arranged to allow current to pass in the writing or reading direction as the case may be.

336 **Superconductive data storage element.** Int. Business Machines Corp., *B.P. 856608*, 21 Dec. 1960. A data storage device has two circuit paths exhibiting superconductivity and of equal inductance in parallel between two terminals to form a closed loop, one path including a portion having a lower Silsbee current than any portion of the other path.

337 **Electro-optical data storage device.** Soc. d'Electronique et d'Automatisme, *B.P. 856930*, 21 Dec. 1960. Data is supplied in the form of a pattern of discrete areas of light to a storage device comprising electroluminescent and photo-resistive members.

338 **Electro-optical data storage unit.** Nat. Cash Register Co., *B.P. 856960*, 21 Dec. 1960. A data storage unit, which can be used for example in a shift register, comprises a pair of serially connected ferroelectric elements connected in series with an electroluminscent device optically coupled to a photosensitive element.

339 **Plug-in transistorised digital computing unit.** Metropolitan-Vickers Electrical Co., Ltd., *B.P. 856980*, 21 Dec. 1960. A plug-in type unit for detachable connection in a digital computing circuit includes one or more unit transistor circuits, each comprising a transistor, three resistors, a capacitor and six terminals interconnected in specified manner.

340 **Magnetic device for handling data signals.** Hughes Aircraft Co., *B.P. 857289*, 29 Dec. 1960. A magnetic device for storing and/or propagating data signals, comprises a magnetic medium to which input means are magnetically coupled to change the state of magnetisation in a predetermined area of the medium; the changed state of magnetisation is moved by magnetically coupled means along a continuous portion of the medium to an area where output means are coupled to the medium.

341 **Counting tube.** Philips Electrical Industries Ltd., *B.P. 857339*, 29 Dec. 1960. This patent is concerned with the improved construction of a collecting electrode in a counting tube in which the electron beam is deflected to different positions to strike the electrode.

342 **Function generator.** D. M. Mackay, *B.P. 857544*, 29 Dec. 1960. A function is generated by means of a cathode ray tube in which the deflection produced by means to which an input voltage is applied is nullified by further deflection means, the voltage applied to which being the required function of the input voltage.

343 **Adder-subtractor.** Curtiss-Wright Corp., *U.S.P. 2943790*, 5 July 1960. This patent describes an arithmetic device for adding or subtracting a pair of numbers in binary-coded decimal, which has arrangements to add binary eight and then subtract binary two (on addition) or to add binary two (on subtraction) if a sum or difference is greater than nine.

344 **Binary adder.** Int. Business Machines Corp., *U.S.P. 2943791*, 5 July 1960. A binary adder which is self-checking, employs logical circuits having input and output transformers.

345 **Counter.** Sperry Rand Corp., *U.S.P. 2944161*, 5 July 1960. A binary counter employing a magnetic amplifier in a flip-flop circuit and one or more gates.

346 **Cryotron.** R. K. Richards, *U.S.P. 2944211*, 5 July 1960. A cryotron which employs a concentric arrangement of four conductors, two for the controlling element and two for the controlled element with certain connections whereby the inductance of the controlling element is extremely small so as to permit very high speed operation.

347 **High speed counter.** Hewlett-Packard Co., *U.S.P. 2944224*, 5 July 1960. A high speed binary counter comprising a bistable oscillator, which may include a helical transmission line, coupled to an electron beam, in a travelling wave tube for example, the beam being modulated to switch the oscillator from one oscillatory mode to another.

348 **Bistable circuit.** N. F. Moody, *U.S.P. 2945134*, 12 July 1960. A bistable circuit employing a semiconductor unit with two effective base electrodes, such as two complementary junction transistors interconnected to form an NPNP structure.

349 **Magnetic core mounting.** Burroughs Corp., *U.S.P. 2945215*, 12 July 1960. Magnetic cores are mounted in openings in a panel with the aid of resilient grommet-like members.

350 **Magnetic drum heads.** Thompson Ramo Wooldridge Inc., *U.S.P. 2945216*, 12 July 1960. This patent describes a shielding arrangement for magnetically isolating the writing and reading portions of a dual head such as may be used with a drum recirculating register.

351 **Data storage device of "twistor" type.** Nat. Cash Register Co., *U.S.P. 2945217*, 12 July 1960. A magnetic data storage device with the advantages of the twistor, but not requiring the application of a mechanically generated torsional strain. A ferromagnetic electrodeposit on the surface of an elongated conductive substrate has a preferred direction of crystal orientation which produces a skewed easy direction of magnetisation relative to the longitudinal axis of the substrate.

352 **Superconductive switch.** Arthur D. Little, Inc., *U.S.P. 2946030*, 19 July 1960. The inductance of a coil having a superconductive core is increased when the core is switched to resistive state by the application of a magnetic field.

353 **Data storage system.** E. Goto, *U.S.P. 2946045*, 19 July 1960. This patent describes a digital data storage system of matrix type which employs ferromagnetic or ferroelectric elements not necessarily having rectangular hysteresis loops, in conjunction with parametrons.

354 **Direct coupled transistor logic circuits.** Bell Telephone Labs., Inc., *U.S.P. 2946897*, 26 July 1960. AND and anticoincidence circuits employ as a basic circuit two transistors with collectors connected in parallel and bases and emitters cross-connected.

355 **Bistable transistor circuit.** Monroe Calculating Machine Co., *U.S.P. 2946898*, 26 July 1960. A bistable circuit employing two transistors and designed for interchange with a similar bistable vacuum tube circuit without change other than in voltage supply circuits.

356 **Flip-flop with redundant transistors.** Litton Industries, *U.S.P. 2946900*, 26 July 1960. A flip-flop of high reliability is of the Eccles-Jordan type and has two sets of four transistors connected in a series parallel arrangement.

ANALOGUE

357 **Desk top computer and companion direct writing recorder . . . a basic research and development tool.** D. A. Taskett, *Auto. Control*, **13**, Dec. 1960, 49-52. After indicating the advantages of using equipment such as the Donner Scientific Model 3500 analogue computer in conjunction with a Brush Instruments Mark II direct writing oscillograph, the use of this equipment for analysis of an electrical filter network and of an electrical shaft positioning system is described.

358 **Introduction to electronic analogue computing.** L. T. Bryant et al., Argonne National Laboratory, *ANL-6187*, July 1960. 81 p.

359 **Special purpose analogue computer.** Gen. Electric Co., Ltd., *B.P. 856738*, 21 Dec. 1960. This patent concerns an analogue computer, suitable for use in conjunction with search radar, for guiding an aircraft on one of two types of pursuit interception manoeuvre of simple and crossing course types.

DIGITAL

360 **The characteristics of computers of the second decade. A review.** D. E. Kilner, *Computer Bull.*, **4**, Dec. 1960, 88-112. In this paper, features of so-called "second generation" digital computers available in the U.K. are discussed and some of their characteristics are tabulated. The computers covered in the discussion and/or tables are as follows: AEI 1010; Bull GAMMA 60 and 300 DP Series; Elliott 502 and 503; EMIDEC 1100 and 2400; English Electric KDF 9 and KDP 10; Ferranti ATLAS and ORION; IBM 1401, 1620, 7030 (STRETCH), 7070, 7080 and 7090; ICT 1301; LEO III; National-Elliott 802/803; NCR 315; and STANTEC Computing System. After discussing the development of digital computers in the first decade, 1949-1959, the distinguishing features of computers of the second decade are briefly introduced. Concurrent operating techniques (time-sharing of one control unit, multiple control, parallel programming) are examined at some length. Changes in the use of the word length and variations in the address system are then considered. After outlining some distinguishing features peculiar to individual computers, checking features and new trends in the use of peripheral units are discussed. Finally, there are some observations on the future of computers. There are four tables which list respectively details of concurrent operating facilities, techniques for providing parallel programming facilities, forms of storage, and operational features. See also Ref. 206.

361 **The English Electric KDF 9 computer system.** G. M. Davis, *Computer Bull.*, **4**, Dec. 1960, 119-120. Brief account of the storage system, arithmetic operations, programming and peripheral units of the English Electric KDF 9 computer system.

362 **The Ferranti Argus process control computer.** T. A. Stones, *Computer Bull.*, **4**, Dec. 1960, 117-118. Brief description of some features of the Ferranti ARGUS which make it particularly suitable for control of industrial processes.

363 **Digital computer.** Nat. Cash Register Co., *B.P. 856166*, 14 Dec. 1960. This patent describes a digital computer in which active elements such as vacuum tubes are reduced to a minimum, magnetic cores are employed in place of diode networks for logical manipulation of binary data, and mutual control is provided between the data processing and programming units.

364 **General purpose digital computer.** Soc. d'Electronique et d'Automatisme, *B.P. 856438*, 14 Dec. 1960. A one-word instruction store in a digital computer, is provided with a decoder arrangement whereby a set of digits occupying a definite location in an instruction word may be differently interpreted according to the significance of another set of digits in the word.

365 **Digital computer.** Nat. Research Development Corp., *B.P. 857511*, 29 Dec. 1960. This patent relates to a digital computer operating in the series mode, which has specified circuitry for performing division.

PROGRAMMING

366 **A comparison of 650 programming methods.** T. B. Curtz, J. F. Riordan and M. Spohn, *Commun. ACM*, **3**, Dec. 1960, 663-664, 671. This paper is concerned with a study of two compilers for the IBM 650; GAT developed by the Statistical Laboratory of the University of Michigan and RUNCIBLE developed by the Computing Laboratory, Case Institute of Technology. After briefly describing the two compilers, they are appraised for the ease with which they can be used and for the efficiency of the programs they produce. It is concluded that GAT is preferable to RUNCIBLE. 2 refs.

367 **Compilation for two computers with NELIAC.** K. S. Masterson, *Commun. ACM*, **3**, Nov. 1960, 607-611. An account of NELIAC, a compiler using a dialect of ALGOL, developed at the U.S. Navy Electronics Laboratory, San Diego, California. NELIAC is used, on the Univac COUNTESS to "bootstrap" itself, i.e. an improved version is written in NELIAC language and then recompiled by itself. Two other versions of NELIAC have been compiled on the COUNTESS. The first, called CDC-1, generates machine code for the Control Data Corporation CDC-1604; the second, called CDC-2, is compiled by CDC-1 and is a program for the CDC-1604. 7 refs.

368 **Improved procedure languages for data processing.** P. R. Bagley, *Commun. ACM*, **3,** Nov. 1960, 599. Summary of research at the Mitre Corporation into ways of improving the techniques currently used in designing problem-oriented languages so as to relieve programmers of as much of their burden as possible even at a possible sacrifice of operating efficiency.

See also :—
Techniques, Refs. 261, 272.

APPLICATIONS

AERONAUTICAL

369 **Wind tunnel interrupts 709 for fast data reduction.** T. M. Bellan, *Control Engng.*, **7,** Dec. 1960, 117-118. Description, by means of captioned photographs, of the use of an IBM data transmission system and the interrupt feature of the IBM 709 by McDonnell Aircraft Corporation to obtain at their polysonic (Mach 0.5 to Mach 5.0) wind tunnel reduced data in plotted form within 15 minutes after completion of a test run.

370 **An investigation of an approach to the problem of determining the optimum design of shrouded propellers. Appendix I. Vortex system. Appendix II. Calculation of thrust and power. Appendix III. Determination of the optimum loading for a heavily loaded propeller having an infinite number of blades. Appendix IV. Oultine of design procedures for shrouded propellers.** R. B. Gray and W. Castles, Georgia Institute of Technology, *PB 150116,* May 1960, 92 p. Two methods of obtaining the necessary optimum combination of design parameters for a lightly loaded single rotation shrouded propeller are described for the case in which the ultimate wake vortex system moves as a rigid body and is composed of helical vortex filaments of equal geometric pitch. One method employs the electrical potential tank techniques while the other uses a digital computer to numerically integrate the Biot-Savart relation. It is concluded that the digital computer approach is the more promising. 7 refs.

371 **Procedures for including temperature effects in structural analyses of elastic wings. Part II. A digital computer solution for the equivalent plate method of thermoelastic analysis.** L. A. Schmidt and H. A. Balmer, Aeroelastic and Structures Research Lab., M.I.T., *PB 149624.* May 1959, 173 p. A general procedure, employing the IBM 704, based on the equivalent plate method of structural analysis for elevated temperature structure has been developed. The program provides a rational method for analysing the static aeroelastic behaviour of thin, low aspect ratio wings subject to elevated temperatures and high wing loadings. The formulation includes coupling between aerodynamic pressures and the thermoelastic distortions, and also coupling between the bending and stretching of the plate. Using the variational principle of Reissner and expanding the deflection and the stress function in terms of assumed modes, two coupled nonlinear matrix equations are obtained and solved by successive linearisation. The IBM 704 program is used not only to carry out the matrix operations but to carry out the considerable number of partial differentiations, double integrations and algebraic operations required to form the matrix elements. Illustrative numerical examples of the use of the program are given. Limitations of the program are discussed and improvements and extensions suggested. 7 refs.

372 **Flight trainer.** Link Aviation, Inc., *B.P. 855516,* 7 Dec. 1960. In a ground aviation trainer, an analogue computer is provided with arrangements whereby the effect of simulated wind is taken into account both during simulation of flight and during simulation of movement of an aircraft on the ground.

See also :—
Design, Ref. 220
Techniques, Ref. 270.

BUSINESS

373 **Computer installation at Newton Chambers.** *Automn. & Auto. Equipment News,* **6,** Dec. 1960, 185-189. An account of the organisation of the National-Elliott 405 installation at Newton Chambers and Company, Limited and its use for payroll and dividend warrant preparation and its proposed use in a comprehensive order processing and sales accounting system for the Chemical Division and for production control in the excavator factory.

374 **DEUCE Users' Colloquium on Business Applications.** *Computer Bull.*, **4,** Dec. 1960, 113-114. Brief account of the papers given at the DEUCE Users' Coloquium on 4-5 October 1960 and covering the following topics: operational research; linear programming; production control and payroll; large-scale statistical processing; and data processing.

See also :—
Simulation, Ref. 398.

CHEMICAL

See :
Mathematics, Ref. 247.
Information Retrieval, Ref. 382.

CONTROL—GENERAL SYSTEMS

See :—
Techniques, Ref. 270.

CONTROL—PRODUCTION AND PROCESS

375 **A computer controlled multi-channel blending system.** *Auto. Control,* **13,** Dec. 1960, 26-30. General account of a petroleum blending control system employing a Bendix G-15. The computer has two main tasks: calculation of set points for individual stocks and additives used in making the blend as a result of initial input data and feedback of measured flow; and monitoring and totalising of the flows of each stock and additive as well as of the total blend.

376 **Prevention of computer errors due to external transients.** L. S. Jimerson and T. B. Lewis, *IBM Technical Disclosure Bull.*, **3,** Dec. 1960, 24. Brief description of the use of transient detection devices and program techniques to minimise the effect of malfunction-producing transients in a process control problem.

See also :—
Learning and Pattern Recognition, Ref. 243.
Digital, Ref. 362.
Business, Ref. 373.

ELECTRONICS

377 **Digital simulator checks space communications design.** D. R. J. White, *Space/Aeronautics,* **34,** July 1960, 125-129. Describes methods of evaluating the design of ground-space vehicle radio transmission systems, using a digital computer.

378 **Molecular amplifiers and generators.** H. R. Lewis, David Sarnoff Research Center, Princeton, New Jersey, *PB 149367,* 15 June 1959, 16 p. Equipment was set up and tested for paramagnetic resonance work in the 40-50 kmc/s range and the 50-70 kmc/s range. The Hamiltonian describing the energy levels of Cr^{3+} in $Ti0_2$ was checked by observing the spectrum at frequencies of 45 and 57 kmc/s. A program was written for the IBM 650 to calculate transition probabilities for spin 3/2 ions in axial or othorhombic environments. Using this program computations were made for the Cr^{3+} ion in $Ti0_2$ at points of interest for maser operation.

ENGINEERING, ELECTRICAL

See :—
Nuclear, Ref. 387.

ENGINEERING MECHANICAL

379 **Balanced-life gears give capacity-to-size optimum.** G. J. Huebner, *SAE Jol.*, **68,** July 1960, 66-77. Discusses the use of a digital computer in the design of gas turbine gearing using the balanced-life approach.

380 **Elastic beam theory for the electronic computer: a recurrence approach.** P. M. Quinlan, University College, Cork, Eire, *PB 150350,* June 1960, 42 p. A new comprehensive approach to elastic beam theory is presented based on the use of generalised step functions. The paper is divided into two parts, the first dealing with uniform beams and the second with non-uniform beams. Uniform beam on continuous supports, whether rigid or elastic, is solved using a new formulation of the three-moment equation in conjunction with a shear-recurrence formula—called the three-supports equation. An alternative solution for continuous uniform beams on elastic supports is given using generalised step-functions. The second part, dealing with non-uniform beams, is based entirely on recurrence formulae obtained from generalised step-function approximations to the deflection and slope equations by differencing. Solutions are obtained for all loading conditions, including concentrated moments and end thrust, or end tension. 11 refs.

INFORMATION RETRIEVAL

381 **Evaluating procedures for processing and searching metallurgical literature.** A. Kent, *Commun. ACM*, **3,** Nov. 1960, 599, 623. Summary of research at Western Reserve University into the technical and economic effectiveness of the processing and searching procedures used for metallurgical literature. 5 refs.

382 **A study of chemical notations.** A. Kent, *Commun. ACM*, **3,** Nov. 1960, 597-598. Summary of research at Western Reserve University, involving a comparison of two specific notation systems used to encode organic chemical compounds.

383 **Test program for evaluating procedures for the exploitation of literature of interest to metallurgist. II. Acquisition of documents for machine searching.** A. Kent, A. M. Rees and J. Melton, Western Reserve University, *PB 149845*, 1960, 47 p.

384 **Test program for evaluating procedures for the exploitation of literature of interest to metallurgists. III. Analysis and quality control.** A. Kent, J. Melton and A. M. Rees, Western Reserve University, *PB 150260*, 1960, 54 p. 4 refs.

See also :—
Learning and Pattern Recognition, Ref. 242.

MECHANICAL TRANSLATION

385 **Automatic translation.** E. v. Glasersfeld, *Commun. ACM*, **3,** Nov. 1960, 623. Summary of mechanical translation research at Milan University, Italy. 12 refs.

386 **Computer evaluation of mechanical translation of languages (Russian to English).** D. L. Johnson, *Commun. ACM*, **3,** Nov. 1960, 597. Summary of research at the University of Washington, Seattle in which, with the aid of an IBM 709, methods of statistical probability and information theory are used to investigate the quality of machine translations of natural languages.

NUCLEAR

387 **Simulation OKs C-Stellarator power supply control system.** J. R. Hurley, *Control Engng.*, **7,** Dec. 1960, 133. The C-Stellarator is an experiment designed to investigate hydrogen fusion processes and the properties of high temperature plasmas. An accurately controlled supply of high voltage, high amperage d.c. is required. This article briefly describes the current control system and its simulation on a PACE analogue computer to determine if accuracy requirements could be met.

388 **A computer program for calculating gamma radiation intensity.** A. Ruyle, University of California, *PB 149917*, 2 Feb. 1959, 14 p. A program is described which calculates the intensity from a set of isotropic point sources at a set of isotropic point detectors in the presence of a set of parallelepiped shields.

389 **Computer program for ranking values and determining probability frequencies of dose and intensity obtained from a Monte Carlo calculation.** R. C. Grassi, University of California, *PB 149913*, 2 Feb. 1959, 37 p. A program has been developed which will give ranked values of dose after an infinite time and ranked values of intensity one hour following burst for a given location (monitoring point). Each value of dose and/or intensity calculated represents the fallout received from a Monte Carlo iteration. In addition, the program will calculate the number values of dose and intensity, respectively, for each throw or iteration, which are above a specified level of radiation.

390 **Grace II—An IBM 709 program for computing gamma-ray attenuation and heating in cylindrical and spherical geometries.** D. S. Duncan and A. B. Speir, North American Aviation Inc., *NAA-SR-Memo-4649*, Nov. 1959, 61 p.

391 **An IBM 650 computer program for determining the thermal diffusivity of finite-length samples.** W. L. Kennedy, Iowa State University of Science and Technology, *IS-137*, June 1960, 59 p.

392 **A machine program for particle position variances and covariances.** C. L. Bisson, University of California, *PB 149928*, 7 April 1959, 22 p. This report gives an IBM 704 program for calculating the variances and covariances of the coordinates of the positions of fallout particles or discs of fallout particles when they reach the ground. 3 refs.

393 **NLLS: A 704 program for fitting non-linear curves by least squares.** P. B. Wood, Oak Ridge Gaseous Diffusion Plant, *K-1440*, Jan. 1960, 62 p.

394 **A program for computing radiation flux from a uniform field.** H. L. Dachslager, University of California, *PB 149914*, 2 Feb. 1959, 5 p. A program is described which computes the radiation flux from an infinite uniform plane contaminated outside a circle. A number of cases can be handled simultaneously.

PHYSICS

395 **A comprehensive system of automatic computation in magnetic and gravity interpretation.** R. G. Henderson, *Geophysics*, **25,** June 1960, 569-585. In the interpretation of magnetic and gravity anomalies, downward continuation of fields and calculation of first and second vertical derivatives of fields are recognised as effective means for bringing into focus the latent diagnostic features of the data. This paper concerns a comprehensive system which has been devised for the calculation of any or all of these derived fields on a digital computer. The integral for analytic continuation above the plane is used with a Lagrange extrapolation polynomial to derive a general determinantal expression from which the field at depth and the various derivatives on the surface and at depth can be obtained. Programming of the computation processes for Burroughs 205 and 220 is briefly mentioned. 15 refs.

SIMULATION

396 **Digital simulation of discrete flow systems.** C. J. Moore and T. S. Lewis, *Commun. ACM*, **3,** Dec. 1960, 659-660, 662. This paper is concerned with the digital simulation of discrete flow systems characterised by the movement of randomly arriving items along interacting channels. Some of the programming problems involved in such simulations are illustrated by a discussion of two simulation studies (on an IBM 650). One study is of the central sorting operation of a large package-handling firm, the objective being optimisation of parameters such as storage capacities and processing rates. The other study, of an airway, was to compare several alternative route and altitude structures over a range of traffic densities.

397 **Simulation Council Newsletter.** J. H. McLeod (Ed), *Instr. & Control Systems*, **33,** Dec. 1960, 2091-2095, 2097, 2099. Consists mainly of summaries of talks, given at the Eastern Simulation Council meeting of 16 May 1960, on "The use of simulation in batch control problems" by M. Hausner, "Use of varistors for function generation" by I. Gruet, "Simulation versus optimization" by W. Drews, "The use of memory channel for fixed bed systems" by R. G. E. Franks, and "Statistical studies" by A. Rubin.

398 **Simulation of economic systems.** G. S. Glinski, *Instr. & Control Systems*, **33,** Dec. 1960, 2100-2101. Briefly indicates how mathematical models of economic systems can be tested by simulation on analogue computers. 15 refs.

399 **Some problems of digital systems simulation.** R. W. Conway, B. M. Johnson and W. L. Maxwell, Cornell University, *PB 148791*, 1959, 40 p. This paper consists of three sections. The first is an attempt to describe characteristics common to many system simulations; the second is a discussion of some problems involved in the construction of a digital simulator; and the third concerns problems that arise in the use of such a simulator. 12 refs.

TRANSPORT

See :
Simulation, Ref. 396.

MISCELLANEOUS

400 **Computer for automatic weather stations.** *Auto. Control,* **13,** Dec. 1960, 58-60. Account of AMOS IV digital computer which processes data from weather-sensing instruments. AMOS (Automatic Meteorological Observation Station) is a joint development of the National Bureau of Standards and the U.S. Weather Bureau.

401 **Determining velocity, stress and strain of moving tape.** B. C. Wang, *IBM Technical Disclosure Bull.*, **3,** Dec. 1960, 12-14. Description of arrangements for measurement of factors which are useful in determining velocty, stress or strain of a moving magnetic tape, comprising photoelectric sensing system and start-stop counting circuits. Elapsed time counts from the counting circuits are recorded by a magnetic tape unit for subsequent calculation of the desired characteristics and for statistical analysis on a digital computer.

402 **Digital computers cut survey costs.** G. J. Harvey, *Engng. & Mining J.*, **161,** July 1960, 77-81. General account of the use by Union Carbide Nuclear Company of an IBM 704 to process mining survey data.

403 **Lighting calculations for thirty-five thousand rooms.** P. F. O'Brien, *Illuminating Engng.*, **55,** April 1960, 215-224, disc. 225-226. Describes how, with the aid of an IBM 709, a comprehensive table was prepared of quantities which specify the illumination and luminous emittance distributions in 35,000 rooms characterised by different geometries and reflective distributions. A portion of the table for 160 rooms is given. 8 refs.

404 **Programming the IBM 704 computer for photometric data reduction, documentation and application.** A. B. Gough, *Illuminating Engng.*, **55,** April 1960, 203-212, disc. 212-214. Describes, with flow diagrams, the use of an IBM 704 for processing photometric data in the design of floodlighting systems. 8 refs.

405 **Application of the digital computer to microhardness determination.** K. D. Holmes, E. Deluca and G. D. Pinching, Rodman Lab., Watertown Arsenal, Massachusetts, *PB 149571,* April 1960, 9 p. A simplified method for determining Knoop or Diamond Pyramid microhardness numbers is established by using the digital computer to convert the measured length of the microhardness impression directly to its corresponding hardness number. Numerical tables are set up which eliminate operator calculations. 2 refs.

406 **The computation of Rawinsonde flights by general purpose automatic computers.** A. Arnold and M. J. Lowenthal, Army Signal Research and Development Lab., Fort Monmouth, New Jersey, *PB 147825,* 15 Oct. 1959, 25 p. The computation required for a Rawinsonde flight is presented. Separate equations are given so that each element of meteorological information may be computed from the output data of Rawin Set AN/GMD-1. The equations are then programmed for a general purpose computer which computes the temperature, humidity, height and wind values from the raw data. 8 refs.

407 **Evaporation and breakup of fuel droplets in one-dimensional gas flow in a combustion chamber.** L. M. Naphtali and S. Z. Burstein, Polytechnic Institute of Brooklyn, *PB 148999,* Jan. 1960, 21 p. A mathematical model was formulated of combustion in a rocket motor as controlled by the evaporation process of an arbitary number of droplets of injected fuel. The model was programmed as a Fortran II subroutine for the IBM 704. Computations revealed that under a wide range of conditions a co-operative breakup occurred in which the increased velocity of gases caused droplet breakup which further increased evaporation. It was concluded that droplet breakup was the most important single parameter in spray combustion. 6 refs.

408 **An iterative analogue computor for study of the turbulent flame properties of elementary combustion chambers.** A. J. Cooper and I. C. Hutcheon, Tiltman Langley Ltd., Great Britain, *PB 150354,* 30 Nov. 1959, 35 p. An iterative analogue computer has been designed and built for solving up to 20 simultaneous equations of the form $\tau_j = \frac{1}{L} \sum_k b_{jk} \psi(\tau_k)$ where L is an adjustable parameter (eigenvalue), b_{jk} is a set of up to 20×20 coefficients and ψ is a linear or nonlinear relationship. Equations of this form arise in the study of turbulent flame patterns in combustions chambers. b_{jk} is then a set of influence coeffiecients which relate the local temperature τ_j at any point j to the rates of heat generation at k points throughout the flame and ψ is a reaction rate function which relates the heat generated at any one point to its own temperature. The coefficients are measured by argon tracer methods using a flow of air through a model combustion chamber and the computer has been used to predict extintion points for different combustion chamber configurations on the assumption of a theoretical reaction rate function. The computer operates in an iterative manner, approaching the correct solution by a series of successive approximations. The whole system is described and operating and maintenance instructions are given. 11 refs.

409 **A percentile program with reloadable output for the IBM Type 650.** A. Dvorak and G. R. Burket, Washington University, Seattle, *PB 147773,* Nov. 1959, 7 p. A modified version is given of a previously reported program for calculating percentile scores. The program permits adding or subtracting previous output tallies from tallies already on the drum. The load hub feature is used for this so that no additional read wiring is required. Through the use of control cards it is possible to perform the following operations as many times as desired and in any sequence: clear accumulation areas; read and tally case cards; add previous output tallies; subtract previous output tallies; and punch tallies currently on drum along with individual percents and percentile values. 2 refs.

410 **Two IBM Type 650 programs to correct correlation matrices for attentuation.** C. E. Wright, Washington University, Seattle, *PB 147891,* June 1959, 7 p. Two IBM 650 programs are reported which have been found to be useful in multivariate psychological analyses. The first of these corrects symmetric correlation matrix elements for attenuation. For 1 to 50 variables, the program performs its function when the row and column identifications of the correlation coefficients refer to the variables of a symmetric correlation matrix. The second program is useful for up to a 50 by 50 non-symmetric correlation matrix where the row and column identifications of the correlations refer to two distinct sets of 50 variables. 4 refs.